Space Weather Technical Forecast

Issued on Wednesday, 26 October 2022 at 13:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms days 2-4 (27th-29th). Slight Chance of Minor (R1) Radio Blackouts throughout. Slight chance of Active electron fluence from day 2 (27th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with two C-class flares from AR3133 on 25th in the northeast quadrant. This is the most active sunspot region, though it only exhibits rudimentary penumbra around its small leader portion. There are four other sunspot regions on the visible disc. AR3130 retains some small intermediate spots with continued proliferation of pores emergence in recent hours. AR3131 in the northeast has developed further, with an increase in intermediate spots following a now large leader. AR3132 in the southwest is a simple unipolar spot. No Earth-directed CME's have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind parameters, as observed by DSCOVR at L1, were indicative of a gradual exit from the High Speed Stream (HSS) of CH34/-. Solar wind speeds declined from slightly elevated at around 420 km/s to slow-ambient at around 360 km/s. Density was average or below. Total magnetic field strength was weak, with the north-south component, Bz, mostly weakly positive, with some weakly negative deflections. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at background or moderate levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with an upward trend and a level of 2.41e6 integrated pfu observed at 26/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low with a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed coronal mass ejections have been observed. The Earth is expected to experience continued slow ambient solar wind speeds during day 1 and the first half of day 2 (26th and 27th). Either during the second half of day 2 (27th) or during day 3 (28th) the Earth is anticipated to connect with the high speed stream related to CH36/+. A further enhancement is possible to elevated solar winds speeds on day 4 (29th) due to the arrival of CH37/+. Geomagnetic activity should remain Quiet (Kp 0-2) with isolated Unsettled (Kp 3) intervals during days 1 and early 2 (26th and 27th). Any time from midday day 2 until day 4 (27th-29th) there is an increasing chance of Active or Minor Storm (G1 intervals (Kp 4-5), as the Earth connects with the high speed streams related to CH36/+ then CH37/+.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background levels. High energy electron flux (greater than 2MeV) is expected to be mainly background to moderate levels at first, but is expected to trend towards higher levels through the period, with continued slow-ambient wind speeds post connection to CH34/-.

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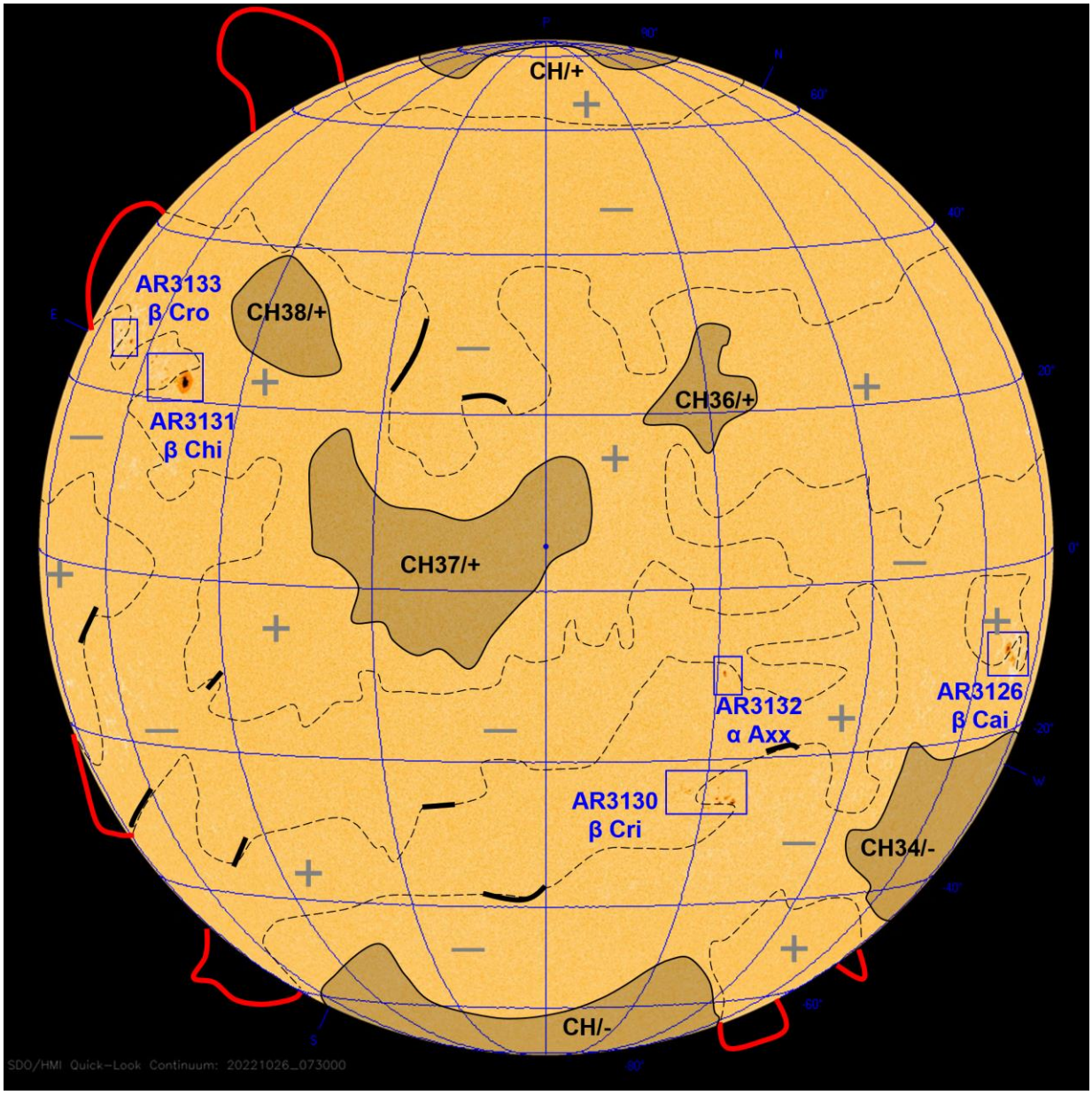
Further reductions are possible from late day (27th) onward due to further high speed streams from CH36/+ and Ch27/+ likely compressing the van allen belts. Electron fluence values are forecast to trend upwards, with a slight chance of reaching the Active threshold from day 2 (27th) onward.

Figure 1. Solar Analysis Valid 26/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

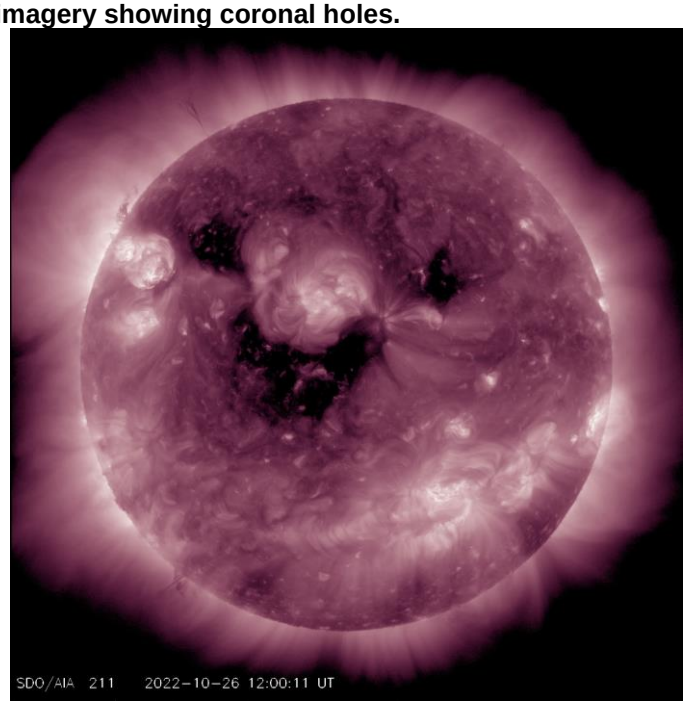
No Earth-directed CMEs have been observed in available imagery.

The Earth will continue to exit the HSS from CH34/- until day 2 (27 Oct), with slow-ambient solar winds declining a little further. An uptick in solar wind levels is forecast either second half of 2 (27th) or during day 3 (28th) as the Earth connects with the HSS from CH36/+. On the last rotation this feature gave elevated levels reaching around 500-550 km/s, and current SETERO A shows similar speeds with an equivalent arrival around midday on 27th. Another enhancement is expected later in the period from CH37/+. With similar winds speeds expected up to around 550 km/s, this would give an arrival of during the first half of day 4 (29th).

Geomagnetic activity is expected to be mainly Quiet with isolated Unsettled intervals initially. From the second half of day 2 (27th), there is an increased chance of Active or G1/Minor Storm intervals, as the Earth connects with the HSS of CH36/+ followed by CH37/+ on day 4 (29th). The polarity of these coronal holes is favoured for stronger connections around the September equinox.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	30	30	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: AIA 211 SDO imagery showing coronal holes.



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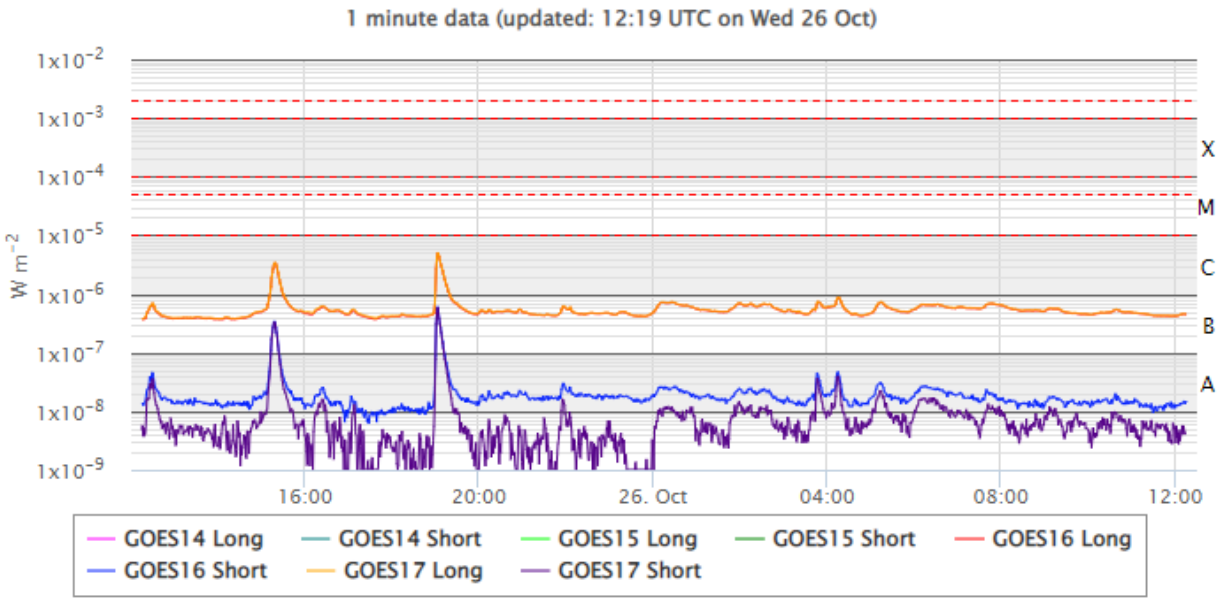
Radio Blackouts - X-Ray Flares:

Solar activity has been Low with five numbered sunspots on the visible disc. Most of the sunspots are of relatively small and benign in activity, with AR3133 the most active, with the C-class flare activity on 25th. AR3131 has rotated onto the northeast of the solar disc and despite an initially benign appearance, as a returning feature, enhanced activity is considered a possibility. AR3126 approaching the southwest limb also continues to display some moderate complexity, with a slight chance of moderate flares also possibly emerging from this spot.

Low levels of solar activity with a daily 70% chance for C-class flares and a slight chance (20%) of isolated M-class flares, mainly from AR3133 and perhaps AR3131 or AR31326.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: 24 Hour X-Ray trace.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background and expected to stay at this level with no significant active regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has been either background or moderate in the past 24 hours, likely due to the waning influence of CH34/- and the relaxation of the van allen belts from the reducing solar wind speed. Electron flux levels are expected to rise in coming days due to the previous charging of the electron fields from CH34/-, with likely high levels of flux by day 2 (27th) before the next HSS arrives day 2 or day 3 (27th or 28th), likely having a similar suppression effect and compressing the radiation belts for perhaps several days.

Electron fluence values are expected to continue on an upward trend in line with apparent increasing flux levels, with a slight chance of reaching the Active (1e8 integrated pfu) threshold day 2 or day 3 (27th or 28th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	20	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: 24 Hour Electron Flux trace (GOES)

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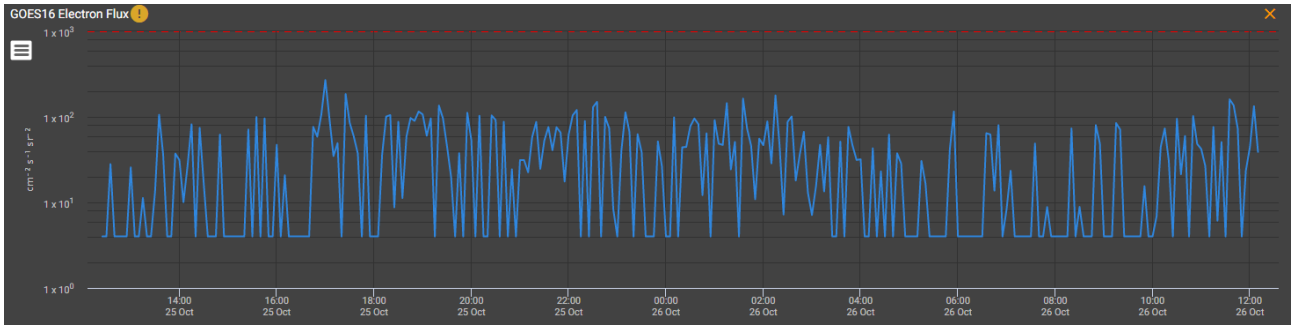

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